RECIPROCITY

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NEW RESEARCH PROGRAM CONCERNING COHESION OF SOLIDS

The Learning Resources and Research Committee of the University of Wisconsin-Superior is supporting an Inquiry Concerning the Cohesion of Solid Matter, proposed by Professor Frank H. Meyer, UW-Superior Department of Physics, and associates for the 1974-5 year.

An editorial focusing the significance of this development appears further on in this issue of RECIPROCITY.

The inquiry is motivated by a new approach to the old unsolved problem of solid cohesion. The new approach originated as one of numerous consequences of a comprehensible revaluation of the nature of physical time and space by Mr. Dewey B. Larson, author, of Portland, Oregon. The essentials of Mr. Larson's Reciprocal System of physics, applied to explain the causation of solid cohesion, are presented by him further on in this issue of RECIPROCITY.

One of the main merits of the Larson conception about how the atoms of any solid substance are caused to cohere is that it is amenable to direct examination by quantitative calculations. For instance, the conception includes formulae from which measurable equilibrium interatomic distances in crystals can be computed from entirely theoretical premises. A formula for these characteristic distances found in crystals of chemical elements has the following form:

$$s_o = 2.94 \times 10^{-8} \ln t / \ln^{\frac{1}{2}} t' \quad \text{cm.}, \qquad (14)$$

where s_o denotes equilibrium interatomic distance and t and t' denote time units, t representing two-dimensional rotational time units and t', one -dimensional rotational time units.

The derivation of equation (14) can be understood only by referring to D. B. Larson's Structure of the Physical Universe, pages 27-32.

Equation (14) can be used to calculate directly the equilibrium interatomic distances for most of the chemical elements in the first half of each rotational group from the rotational values corresponding to the displacements previously determined by Larson for each individual element. While equation (14) is thus applicable to many elements of the Periodic Table, additional formulae, appropriate modifications of (14), have been developed for the other elemental groups, such as the inert gas group. The Larson theory also can be and has been extended to explain equilibrium distances in chemical compound solids.

In the March, 1942 Scientific Monthly Karl Darrow, one of the more thoughtful leaders the American Physical Society has had, focused on a major inadequacy of modern and classical theories of solid cohesion. For solid interatomic equilibrium to exist both repulsive and attractive forces clearly are required, but previous theory has been unable to find the repulsive force. While classical theory supposed that it was due to the impenetrability of atoms when in contact

with one another, x-ray crystallography has disclosed that atoms keep their distances, however small, in solids and don't come into contact even when under compression. Modern solid state physicists have done no better in characterizing the repulsive force of cohesion and, as Darrow says, they take refuge in evasion, and "manage to avoid the question" by using "words not conveying directly the notion of force".

Straightforward computation of equilibrium interatomic distances in crystals of chemical elements and also chemical compound substances can be produced on the basis of x-ray crystallographic structure measurements. An abundance of such data is presently available and anyone with x-ray diffraction equipment can confirm and extend these experimental determinations.

Therefore, it is quite feasible to examine whether the Larson formulae yield theoretical equilibrium interatomic distance values in solids agreeing with the experimental values. Furthermore, any solid state theorist whose faith in the orthodox theory of chemical bonding is sufficient is welcome to try either improving on the Larson formulae or producing better formulae for the purpose, wholly predicated on prevailing solid state hypotheses about chemical bonding through electrical forces.

PHYSICS-ON THE MOVE?

EDITORIAL-G. Windolph, Quincy, Illinois

A new theory meets opposition from various sources. Funding agencies, such as the National Science Foundation, may refuse to back research on the theory; publishers or editors may refuse to accept books or articles dealing with the new theory; other scientists may reject the new ideas. Ultimately, however, the important opposition is that from the scientists, since the funding agencies and publishers or editors make their decisions in consultation with reputable scientists. A certain amount of resistance to the new gives a degree of stability to the scientific endeavor; unexamined opposition can lead to stagnation. The major reasons (1) why scientists reject new theories are the following: a) The actual concepts and theories presently accepted are considered established beyond reasonable doubt. b) The presently accepted methodology is held sacrosanct. c) Recognized authorities or specialists often ignore those who are not authorities or specialists in the field under discussion.

An example of the first is given by M. Polanyi (2). After discussing the rejection of his work on the potential theory of adsorption, he concludes:

> The instance of the miscarriage of science of which I have told the story...makes me ponder the perils of a particular dangerous mode of scientific explanation. The physicists of the period from 1912 to 1930 considered it as established beyond reasonable doubt that only electrical forces could account for intramolecular attraction. Arguments for the insufficiency of this explanation were rejected as unscientific, because no other principles of molecular interaction appeared conceivable....This kind of argument, based on the absence of any alternative that is accepted as scientific, may often be valid, but it seems to me the most dangerous application of scientific authority.

An example of the second is the criticism of D. B. Larson's reciprocal theory because it is not sufficiently mathematical. (Larson has sufficiently answered this criticism.) Coincidentally, Mendel apparently met opposition because his genetic

theory was too mathematical for the biologists of the time. As an example of the third case, the principle of conservation of energy was opposed because Helmholtz was not a specialist in physics.

As to the Reciprocal Theory of D. B. Larson, I do not see the question of methodology as a major obstacle to its acceptance. The resistance from authorities and specialists is a greater obstacle to the theory's becoming known than to its being accepted. This resistance has to be reckoned with, but even if the theory were widely publicized, there would still remain what I consider the most serious source of trouble: It is contrary to so many of the assumptions, ideas, and theories that are well-established, if not in fact, at least in the thinking of present day scientists. Just to take one example, in this day of nuclear power plants and threatened nuclear war, it takes an unfettered mind indeed even to open a book entitled: The Case Against the Nuclear Atom. Moreover, the theory seems both too simple and too complex. It postulates that the geometry of the universe is Euclidean, that magnitudes are absolute, that the universe conforms to the relations of ordinary commutative mathematics. Most scientists have so assimilated the concepts of relativity and quantum mechanics that the reciprocal theory will seem too naive, a step backward. On the other hand, who can understand a three-dimensional time when it's hard enough to get a clear idea of one-dimensional time? How can motion be the basic "stuff" of the universe when it's so "obvious" that you can't have motion without something moving? Thus the theory faces possible opposition from the sophisticated scientist as well as from the one who appreciates a common-sense view. Since the theory is a fundamental one, the resistance will come from the physicists. Correspondingly, from among the physicists must come those open-minded enough to give the Reciprocal Theory its day in court.

If science were in a perfect state today, it would be hard to urge the study of a new theory. Anyone, however, who is conversant with present day scientific anomalies, as the science-historian Thomas Kuhn would call them (3), realizes that, if ever there was a need for a new "paradigm" (to use the same author's term), today is the time for it. Some of the indications are the following: a) The proliferation of subatomic particles without an adequate theory to account for them despite the long search for the no-show quarks; b) The problem of what (and where) are the quasars; c) The different versions of relativity theory; d) The continued efforts to find a unified field theory without any obvious success; e) The multiplicity of cosmological theories of which P. Morrison says, "All theories so far face the tasks set for them by physics with little success." (4) f) The dubious conceptual foundation of quantum mechanics which prompted the following avowal from H. Putnam: "...No satisfactory interpretation of quantum mechanics exists today. The questions posed...go to the very foundations of microphysics, but the answers...are...unsatisfactory. Human curiosity will not rest until those questions are answered, but whether they will be answered by conceptual innovations within the framework of the present theory or only within the framework of an as yet unforeseen theory is unknown." (5)

The almost wild speculations in the field of particle physics (with its partons, quarks, mini-black-holes, tachyons), as well as in cosmology (with its bigger black holes, unconstant gravitational constant), not only show that there is a need for new theory, but also indicate that there is an open-mindedness among scientists today. This is an encouraging sign. There are other indications that the time is ripe. There is a new willingness to listen to unorthodox ideas--ideas which would have been rejected as being altogether outside the pale of science not too many years ago. Consider the recent investigations into extra-sensory perception (6), altered states of consciousness (7), and transcendental

meditation, or the hearing given to Velikovsky (8), or the case of Uri Geller (9), Public opinion now allows open discussion of such former "heresies" as no-growth economy, creation research, or plant psychology. In such a climate there should be no hesitation on the part of scientists to engage in a long overdue study of the Reciprocal Theory proposed by D. B. Larson fifteen years ago in his first book, "The Structure of the Physical Universe," and applied to a very modern problem in his fifth book, "Quasars and Pulsars," in 1971.

It is therefore encouraging to hear that Professor Frank Meyer has received a grant from University of Wisconsin-Superior to explore the implications of the Reciprocal Theory in solid state physics. It is a credit to Professor Meyer as well as to his university that such a step is being taken. It may well be the breakthrough that those interested in the Reciprocal Theory have been waiting for. It confirms what John Watkins says relative to Thomas Kuhn's study of scientific revolutions: "...It is not true that a reigning paradigm exercises such a monopolizing sway over scientists' minds that they are all unable to consider it critically, or to toy with (without necessarily embracing) alternatives to it. It means that the scientific community is not, after all, a closed society whose chief characteristic is 'the abandonment of critical discourse.'" (10) Professor Meyer's research may make an important contribution to the understanding of solid state physics, but its greatest contribution could very well be the stimulus it provides other scientists to investigate thoroughly the Reciprocal Theory which holds promise of being the first truly unified theory of the foundations of the physical universe.

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(1) These ideas are adapted from Bernard Barber: "Resistance by scientists to scientific discovery." 1961. Science 134:596-602.
(2) Polanyi, M. 1963. "The Potential Theory of Adsorption." Science 141:1010-3.
(3) Kuhn, Thomas S. 1962. The Structure of Scientific Revolutions. U. of Chicago.
(4) Morrison, P. 1965. "The Physics of the Large," in Beyond the Edge of Certainty. R. G. Colodny (ed.). Prentice-Hall.
(5) Putnam, H. 1965. "A Philosopher Looks at Quantum Mechanics," in Beyond the Edge of Certainty. R. G. Colodny (ed). Prentice-Hall.
(6) Schmidt, H. 1969. "Anomalous Prediction of Quantum Processes by Some Human Subjects." A facsimile report. U.S. Atomic Energy Commission, Oakridge, Tenn.
(7) Holden, C. (Reporter): "Altered states of consciousness: Mind researchers meet to discuss exploration and mapping of 'inner space,'" Science 179:982f. Mar. 9, 1973.
(8) "Velikovsky: AAAS Forum for a Mild Collision." News and Comment. Science 183:1059-62. March 15, 1974.
(9) Science News Report: Geller Performs for Physicists. Science News 106:46. 1974. Further studies were eventually published in Nature.
(10) Watkins, J. 1970. "Against 'Normal Science,'" in Criticism and Growth of Knowledge. I. Lakatos and A. Musgrave (ed.). Cambridge U. Press.

DR. ALFRED ROMER ON HOW TO CHOOSE A THEORY

"A scientific theory ought to be comprehensive. Nothing is more satisfying than a theory which, starting from a limited set of hypotheses, can account for phenomena by the dozen."
Also, "A scientific theory ought to be inflexible. Once its initial hypotheses have been established, there should be no freedom of adjustment by which it can be altered to meet the unexpected." -- American Journal of Physics, August, 1973.

THEORY OF SOLIDS

D. B. Larson, Portland, Oregon

The objective of the project being undertaken by Professor Meyer and his associates is to test the validity of the explanation of the cohesion of solids derived from a development of the consequences of the fundamental postulates of the Reciprocal System of physical theory, the basic premise of which is that the physical universe is composed entirely of discrete units of motion.

In a universe having the properties specified in these postulates, the natural system of reference, the datum from which all physical activity extends, is not the stationary system to which such activity is ordinarily referred, but an expanding system in which each location is moving outward from all others at unit speed. The atoms of matter occupying such locations are carried outward by this movement of the space-time reference system. Coincidentally, they are moving in the opposite direction by reason of their gravitational motion. The term outward, in this connection, refers to the direction with respect to unit distance. Since the atoms are separated by less than unit distance in the solid state, the progression of the reference system moves them closer together, and their gravitational motion moves them farther apart. The gravitational effect decreases with distance, while the space-time progression remains unchanged, and an equilibrium is therefore reached at a definite distance, which depends on the magnitudes of the atomic rotations and on the relative orientation of the interacting atoms.

Where nothing exists but motion, as in the postulated universe, every physical entity or phenomenon is either some kind of a motion, a combination of motions, or a relation between motions. Development of the consequences of the fundamental postulates leads to the identification of atoms of matter as combinations of rotational motion in three dimensions, the nature of this motion being such that it has a scalar effect (gravitation) in opposition to the outward movement of the reference system. A certain minimum amount of such motion has been found necessary in order to produce the properties that we recognize as those of matter, and the minimum combination is identified as hydrogen. Successive additions of further units of motion conform to a definite pattern determined by probability considerations, and hydrogen is therefore followed by a series of specific combinations, which we identify as the chemical elements. The magnitudes of the three rotations of each of these elements can be represented by a unique set of three numbers.

Inasmuch as the combinations of motions are the atoms, and the speeds of rotation in the three dimensions are the only significant features of these atoms, it follows that the set of three numbers which represents the rotational speeds of an element determines the numerical magnitudes of all of the physical and chemical properties of that element, and those of the contributions which that element makes to the properties of chemical compounds. It is theoretically possible, therefore, to devise a system of mathematical expressions for each physical property, into which the numbers representing the rotational speeds of the element or elements can be inserted to obtain the values of the property in question.

Such expressions have already been developed for a number of physical properties, of which the volume relations have been the most extensively investigated. The basic equation for calculation of the inter-atomic distance in the solid state was included in the original presentation of the Reciprocal System of theory in The Structure of the Physical Universe, published in 1959, along with an

explanation of the most common of the modifications of the basic expression that are required by alternate structural patterns. Calculations on this basis for the simpler types of crystals were shown to agree with values reported from experiment, within the accuracy of the experimental results. Professor Meyer is now undertaking to extend these correlations to a wider variety of substances and to a higher degree of accuracy to obtain a definitive answer to the question as to the validity of the theory.

QUESTION BOX
Ronald W. Satz

What says the Reciprocal System about some of the significance and implications of spectroscopic phenomena? - Several Readers

The Electromagnetic Spectrum

Name and Uses	Conventional Frequency	Natural Frequency	Inverse
Very Low Frequency Radio, Long distance and submarine communication.	10^4 Hz	1.52×10^{-12}	Ultrahigh energy gamna rays.
Longwave Radio. Broadcasting	10^5 Hz	1.52×10^{-11}	Ultrahigh energy gamma rays.
Shortwave Radio. Long distance communication via the ionisphere.	10^7 Hz	1.52×10^{-9}	Ultrahigh energy gamma rays.
VHF Radio. Television, radar, radio astronomy.	10^9 Hz	1.52×10^{-7}	Gamma rays.
Centimetric Radio. Satellite communications, radar.	10^{10} Hz	1.52×10^{-6}	Gamma rays.
Shortest radio waves, longest infrared.	10^{12} Hz	1.52×10^{-4}	X-rays.
Infrared. Molecular spectra.	10^{14} Hz	1.52×10^{-2}	X-rays atomic spectra.
Visible light.	4.2×10^{14} to 7.5×10^{14} Hz	6.39×10^{-2} to 1.14×10^{-1}	Ultraviolet.
Ultraviolet. Atomic spectra.	10^{16} Hz	1.52	Visible light.
X-rays	10^{18} Hz	1.52×10^{2}	Infrared. Molecular spectra.
Gamma rays.	10^{20} Hz	1.52×10^{4}	Radio waves.

In order to convert the natural value of the frequencies in the Reciprocal System to conventional values, a conversion factor is needed. Mr. Larson has identified this factor as the Rydberg frequency, the Lyman series limit of atomic hydrogen. This frequency is $R = 6.576 \times 10^{15}$ half-cycles/sec. Thus any conventional frequency may be divided by this factor to obtain the value of the natural frequency. Using the conventional values listed in Optics by F. Graham Smith and J. H. Thomson, the accompanying Table results.

In general, spectra may be classified as thermal generated and explosion generated.

1. Thermal Radiation. From the Table the reader can observe that atomic and molecular spectra are distributed on opposite sides of unit natural frequency. (An implication is that a bodily movement of an atom would be similar to a molecular motion). Atomic spectra result from time-region motion, whereas molecular spectra result from time-space region motion. In the time region the equivalent thermal velocity of radiation is $({}^1/t)/t$ or ${}^1/t^2$. Therefore, we have essentially a continuous spectrum in this region in which

$$v = R({}^1/t^2) = R({}^1/a^2)$$

where a goes from ∞ to 1. Velocity in the time region is in equilibrium with energy in the time-space region, and so when displacement is b, the velocity is ${}^1/b$ and the energy per unit mass is ${}^1/b^2$. This time-space region motion is oppositely directed from the time region motion and so is substracted from it. The result for hydrogen, which has no modifying factors, is the discrete line spectrum

$$v_H = R({}^1/a^2 - {}^1/b^2)$$

Mr. Larson discusses this further on pages 122-125 of Structure of the Physical Universe.

Normal yellow sunlight is a consequence of thermal motion. The atoms and molecules of the sun are moving at speeds less than unity and the U-B index is positive. As indicated in the Table, the inverse of visible light is ultraviolet light. This may be produced by atoms and molecules moving at speeds greater than unity, giving a negative U-B index. In this case, the energy increases with decrease in frequency -- inverse thermal radiation. These deductions of Mr. Larson are confirmed by observations of the thermal spectra of quasars and seyfert galaxies.

2. Explosion-generated Spectra. The frequency of the photons which form the "substrate" of rotating particles (atoms) is equal to a space displacement above unity. In violent explosions (radioactivity) the rotational motion of atoms reverts to this linear motion in the form of gamma rays. Thus supernovae and exploding galaxies are sources of gamma rays. Some of the matter of these supernovae and/or galaxies is accelerated to speeds greater than unity, and photons with frequencies just the inverse of gamma rays are radiated: radio waves, as shown in the Table. Again, there is an inverse distribution of energy with wavelength. Six sources of such radio waves are given by Mr. Larson on pages 154-156 of Quasars and Pulsars.

Another observation can be made from the Table. The inverse of the lower frequency radio waves is yet to be found. Once facilities are improved, much more energetic gamma rays will be discovered.

INCORPORATION OF NSA

Important future advantage would result from more formally organizing ourselves, NEW SCIENCE ADVOCATES, publisher of RECIPROCITY. As a growing movement interested in enabling Mr. Dewey Larson's Reciprocal System to be examined by more men and women, we wish to investigate practical means of accelerating our growth without forgetting our purpose. The legal corporate form of structing our organization is a recommended step in the direction of our objective.

Your Editor proposes the incorporation of NEW SCIENCE ADVOCATES in Wisconsin, primarily to obtain lower cost privilege for mailing RECIPROCITY, beginning as early in 1975 as possible. This is the single most effective step that presently can be taken to keep down the cost of circulating RECIPROCITY, as the past two years of inquiry have disclosed. There are, however, immediate costs of incorporating and also of obtaining third class mailing rate for qualified non-profit organizations. It seems advisable to retain an attorney to incorporate and I have approached an attorney in Superior, Wisconsin, who has quoted the following costs:

$300.00	Attorney's fee
25.00	Secretary of State Filing Fee
5.50	Douglas County Keeper of Deeds
10.00	Corporate Seal
$340.50	Money Cost of Incorporating

By keeping costs of circulating RECIPROCITY to a minimum, we can focus on increasing circulation and improving quality of our publication, which in turn probably is the best way to insure a steady, meaningful growth of our movement.

If the present executive board adopts this proposal, a set of democratic bylaws for NEW SCIENCE ADVOCATES can be adopted, including election of provisionally selected officers by a membership of duly defined categories (individual, husband-wife, worker, student, etc). At present we do not have a Treasurer; a provisional Treasurer should be designated.

An underlying question is do the readers of RECIPROCITY and members of NEW SCIENCE ADVOCATES wish to pay the costs of growing now to speed growth and save costs tomorrow?

If 2/3 this cost of incorporating NEW SCIENCE ADVOCATES can be raised before New Year's Day, 1975, NSA will be incorporated at the start of 1975, if approved by the Executive Board.

HAVE YOU SEEN
Dr. E. L. Lippert, Feature Story Editor

the article on "How To Choose A Theory" by Alfred Romer, American Journal of Physics, August, 1973, several quotations from which are printed on page 4 of this issue of RECIPROCITY?

A theory which fulfills both quoted Romer criteria of an excellent scientific theory is the Reciprocal theory, formulated by D. B. Larson. Indeed, the Reciprocal theory does not even have a close competitor on this ground.

the article, "Observational Paradoxes in Extragalactic Astronomy" by H. Arp in Science, December, 1971? The article concludes with the words:

"Physically we know the least about these peculiar objects (quasars, etc.) and they are the ones for which there is the greatest a priori chance that new and unknown mechanisms are at work....If the observations stand, then we must conclude that sonething new of vast importance is happening and we should get on with the exciting job of finding out more about it."

In the quest for finding out more about the new and hitherto unknown mechanisms at work originating quasars, radio galaxies, etc, reader, read D. B. Larson's book, Quasars and Pulsars.

the article, "On the Foundations of the Hypothesis of Discrete Character of Space and Time" by R. A. Arnov in the book, Time in Science and Philosophy, edited by J. Zeeman?

The author, Arnov, quotes the Philosophical Notebook of V. I. Lenin about the nature of motion:

"Motion is the essence of space and time. The fundamental concepts express this essence: (infinite) continuity (Kontinuität) and 'punctuality' (=denial of continuity, discontinuity). Motion is the unity of continuity (of space and time) and discontinuity (of space and time)."

The philosophical reflections of Lenin prompt the inquiry whether the reciprocal character of space and time implies that motion exists in discrete units, which D. B. Larson's first fundamental postulate asserts and which hitherto has been overlooked.

the article, "Albert Einstein and the Quantum Riddle" by Alfred Landé, American Journal of Physics, June, 1974?

The author, Landé quotes Einstein:

"The highest task of the physicist is the search for those universal elementary laws from which the cosmos can be built up by pure deduction."

"If we only could clarify, at least to some degree, the principal reason behind the quanta. But my hope to see this happening during my lifetime becomes dimmer and dimmer."

Is not the reason why the WORLD IS A QUANTUM WORLD simply a consequence of the reciprocal character of space and time, as supposed by D. B. Larson in his Structure of the Physical Universe?

the article, "Intercontinental Radio Astronomy", by K. Kellerman, in Scientific American 226:74, February, 1972? Discussing the energy output of quasars, the author says:

"Some astronomers believe that here we have reached the limit of conventional physics and that only fundamentally new theories will explain the seemingly fantastic output of galactic nuclei and quasars."

A fundamentally new theory of the energy output of quasars in accord with the currently available radio astronomy evidence appears in D. B. Larson's book, Quasars and Pulsars.

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